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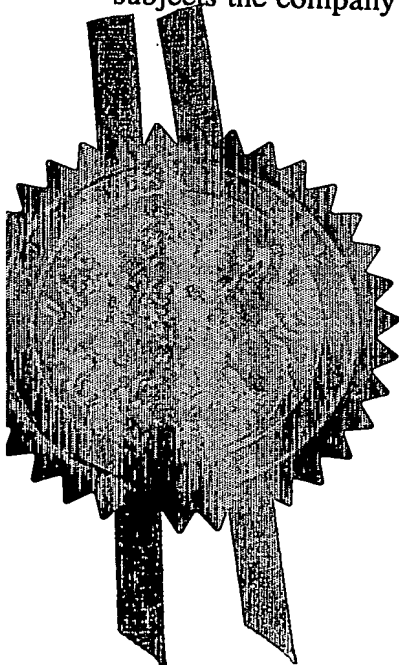
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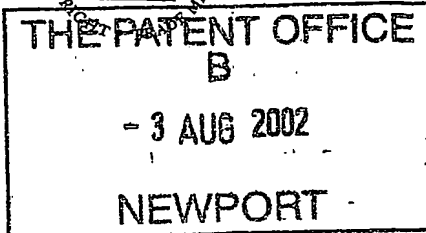
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Dated 10 September 2003

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1. Your reference

DM/ASG/ED/P12279GB

2. Patent application number

(The Patent Office)

0218088.3

05AUG02 E738460-3 000239

P01/7700 0.00-0218088.3

3 AUG 2002

3. Full name

each applicant (underline all surnames)

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111 Westerhill Road  
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United Kingdom

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

7340698002

4. Title of the invention

Improvements in and Relating to  
Display Devices

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom  
to which all correspondence should be sent.  
(including the postcode)

Cruikshank & Fairwather  
19 Royal Exchange Square  
Glasgow G1 3AE

Patents ADP number (if you know it)

547002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
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Date of filing  
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
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Description

16

Claim(s)

Abstract

Drawing(s)

6 x 6 

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Priority documents

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Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application

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Date

CRUIKSHANK & FAIRWEATHER

2 August 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Dr David Moreland  
0141 221 5767

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IMPROVEMENTS IN AND RELATING TO DISPLAY DEVICES

FIELD OF INVENTION

The present invention relates to an improved sheet form member or "applique" for use, for example, as a display, decorative panel or moulding, and more particularly, though not exclusively, to a sheet form member or applique having at least one integrally formed upstanding portion or "rim", for example, for use in a facia of an automotive vehicle.

BACKGROUND TO INVENTION

Planar appliques are used for displaying information and for providing added aesthetic appeal to facias of automotive vehicles. For example, such appliques are used as speedometers, rev. counters or the like.

A feature that has been added to instrumentation facias, for reasons of aesthetic appeal, are chrome or mirror like rings, which form a rim that surrounds an instrumentation gauge. Typically such rims are provided for the speedometer and engine speed or rev. counter gauges.

A known method of creating such instrumentation facias, having rims, is to mount a separately formed rim or rims on a substantially planar applique. Individually moulded rims are mounted to the applique by means of ultrasonic welding or heat welding. The applique is typically a flat polycarbonate sheet which may have printing thereon. Each of the individually moulded rims is typically formed from an ABS (acrylonitrile butadiene styrene) plastic, which is in turn exposed to a

vacuum metalisation process in order to give each rim a chrome or mirror like effect.

The process of vacuum metalisation has the disadvantages of having a high fall out rate, as well being environmentally unfriendly. In addition, the process of mounting the rims to the applique has the disadvantage of requiring additional manufacturing steps and time, which ultimately leads to higher production costs. Particularly careful alignment of the applique and rims is required.

10 It is an objective of at least one aspect of the present invention to obviate or at least mitigate the aforementioned problems of the prior art.

#### SUMMARY OF INVENTION

15 According to a first aspect of the present invention there is provided a sheet form member or applique having at least one portion integrally formed thereon, said portion having a height of at least 4 mm from a surface of the sheet form member.

20 Provision of a sheet form member having an upstanding portion integrally formed thereon eliminates the need to have individually formed rims affixed to the sheet form member, thereby reducing the number of manufacturing assembly steps required and the associated costs involved therewith.

25 The sheet form member may be adapted for use as a display panel or decorative panel, for example, for an instrumentation panel of an automotive vehicle.

Preferably, the height of the portion formed is between

about 4 mm and 9 mm.

More preferably the portion height may be between about 4 mm and 7.5 mm.

In one embodiment the portion height may be around 7.5 mm.

5 The portion may be upstanding from a front surface of the sheet form member, and may be continuous, that is to say, form a closed shape. In such case the portion may be termed a "rim" or "ring".

10 The closed shape may be substantially circular, oval, elliptical or the like or a segmented circle, oval or ellipse. The shapes may be selected from those generally used for display gauges of a fascia of an automotive vehicle.

Preferably the portion comprises a first wall, a second wall, and a top part and preferably has an open base part.

15 Preferably the base part of the portion has a width from an outside of the second wall to an inside of the first wall in the region of 5 mm to 9 mm.

The portion may project from a substantially planar surface of the sheet form member.

20 Preferably the portion circumscribes an area of said planar surface.

Preferably the first wall is convex in shape when viewed from a front of the sheet form member. The first wall of said portion may comprise part of a circle having a radius of between  
25 about 10 mm and 20 mm.

Preferably the second wall of said portion may be substantially vertical.

The second wall may be inclined at a shallow angle to

the top part of the portion.

Preferably the top part is angled, the first wall being higher than the second wall and the top portion comprising part of a circle having a radius of about 0.5 mm.

5 ~~----- In a preferred embodiment there are provided two rims -----~~  
extending from the front surface of the sheet form member. One rim may be provided for a speedometer gauge, whilst the other rim may be provided for an engine speed (rev) counter.

Advantageously, the sheet form member may be provided with  
10 a pressure sensitive adhesive coated on a second or rear surface.

Preferably a spacing between outside walls of each of the two rims is about 45 mm to 50 mm.

Preferably a planar portion of the sheet form member has a thickness of between 0.25 mm and 0.5 mm.

15 Preferably the applique is made substantially from a plastics material, e.g., polycarbonate. Alternatively the sheet form member may be made from a blend of polycarbonate and polybutylene-terraphthalate (PBT) or from ABS.

The sheet form member may be printed with a substantially  
20 single colour of ink, e.g., black.

The at least one rim may be silver or chrome coloured, and may be provided with an aluminium resin coating e.g., on an inner surface thereof.

The sheet form member may be provided with a printed design.  
25 The printed design may be created by printing on a first and second surface of the sheet form member.

The sheet form member may be a laminate, that is to say comprise of two or more layers laminated together.

According to a second aspect of the present invention there is provided a component for an automotive vehicle comprising a sheet form member according to the first aspect of the present invention.

5 The component may comprise an instrument or gauge assembly.

Preferably the component further comprises a rigid backing part having the sheet form member mounted thereto. The sheet form member may be moulded to the backing part. Alternatively, the sheet form member may be glued or otherwise fixed to the  
10 backing part.

Preferably the backing part is made from a plastics material, e.g., polycarbonate or ABS.

According to a third aspect of the present invention there is provided an automotive vehicle including a sheet form member  
15 according to the first aspect of the present invention.

According to a fourth aspect of the present invention there is provided a method of forming a sheet form member according to the first aspect of the present invention the method comprising the steps of :

20 providing a substantially planar sheet; and  
forming said portion on said substantially planar sheet.

The portion may be formed by a forming process such as "pressure forming". Pressure forming is a process typically  
25 including heating the sheet form member, which may be a planar sheet, such that the sheet is able to take the form of a mould to which the sheet is applied. Pressure forming can use a fluid, e.g. air or gas, pressure to force the substrate into the mould



by pushing or sucking via increased or reduced pressure on one side of the sheet such that the sheet takes the shape of the mould.

Alternatively the forming process is performed by "match  
5 ~~metal forming~~". Match metal forming is a process of shaping a  
sheet by use of two moulds between which a normally heated sheet member is placed. One of the moulds is used to force the sheet into the other mould such that the sheet may take a desired form. It has been found that the process of match metal forming has the  
10 added advantage of reducing the problem of wrinkles being formed on the substantially planar sheet in the vicinity around the portion.

The substantially planar sheet may be made substantially from a plastics material, e.g., polycarbonate or a mixture or  
15 blend thereof.

The substantially planar sheet may be a laminate. That is to say the substantially planar sheet is made of a number of sheets layered and bonded or adhered together.

The substantially planar sheet may have printing on first  
20 and second sides thereof.

Preferably the method includes the step of applying to an area of a second surface of the substantially planar sheet an ink, e.g. a chrome or silver coloured ink, e.g., an aluminium based ink resin, the area then being formed into the portion.

25 According to a fifth aspect of the present invention there is provided a sheet form member or applique having an ink coating applied to a surface, e.g., an obverse surface thereof, a pigment of the ink of said ink coating being dissolved in a high

temperature resin base.

Herein by "high temperature" is meant that the resin has a softening temperature in the region of about 200°C and above. In one embodiment a high temperature resin base having a softening temperature of about 205°C may be used.

The use of a high temperature resin based ink provides the added advantage of producing a sheet form member that can be manipulated by a forming process to produce a raised portion coincident with the ink coating, due to the elastic and high temperature resistant properties of such resin based inks.

Preferably the resin base for the coating is a dissolved plastics material. The plastics material may be a polycarbonate material.

Most preferably the plastic material is a copolycarbonate based on a combination of bisphenol A (4,4'-isopropylidenediphenol) and bisphenol TMC (trimethylenecyclohexane bisphenol).

Preferably the plastics material is dissolved in a non-halogenated solvent such as toluene, tetrahydrofuran, ethyl acetate or butanone.

Providing a resin based copolycarbonate that is soluble in non-halogenated solvents provides added ecological advantages when it comes to preparation of solutions or coatings and, more especially, the processing and application of these solutions or coatings.

Preferably the resin based ink contains a chrome and/or aluminium pigment.

Preferably the pigment comprises particles or flakes having

an average size in the range 2 to 4 mm in diameter or length.

The ink coating may form a closed shape, and the closed shape may be annular, oval or elliptical or the like, or segmented annular, oval, elliptical, or the like.

5-----5-----  
Preferably the closed-shaped ink coating has a width of between about 4 mm to 8 mm between an inside and outside of said shape.

Preferably the sheet form member has a thickness of between 0.25 mm and 0.5 mm.

10 Preferably the sheet form member is made from substantially polycarbonate. Alternatively the applique is made from a blend of polycarbonate and poly-butylene-terraphthalate (PBT).

The sheet form member may be provided with a printed design. The printed design may include first and second surface printing.

15 The sheet form member may be provided with at least one portion integrally formed thereon, said portion having a raised height of at least 4 mm from the obverse surface of said sheet form member.

20 Preferably said ink coating is substantially coincident with said portion.

According to a sixth aspect of the present invention there is provided a component for an automotive vehicle including a sheet form member according to the fifth aspect of the present invention.

25 Preferably the component further comprises a rigid backing part having the sheet form member moulded thereto. Alternatively, the sheet form member may be glued or otherwise adhered to the backing part.

Preferably the backing part may be made from a plastics material, e.g., polycarbonate or ABS.

According to a seventh aspect of the present invention, there is provided an automotive vehicle including a sheet form member according to the fifth aspect of the present invention.

According to an eighth aspect of the present invention there is provided a method of providing a sheet form member according to the fifth aspect, the method comprising the steps of:

providing a substantially planar sheet; and  
applying an ink coating thereto.

The ink coating may be applied by screen printing, pad printing, or similar technique.

The sheet used may be of a substantially plastics material, e.g., polycarbonate or a blend thereof.

The planar sheet may be printed on first and second sides of said sheet.

The method may include the step of producing a laminated sheet form member by laminating a further planar sheet form member, e.g., of polycarbonate, to a reverse side of said sheet form member.

The method may further include the step of forming at least one portion integrally formed on the sheet form member, said portion preferably having a raised height of at least 4 mm from the obverse surface of said sheet form member.

Preferably the at least one portion is substantially coincident with said ink coating.

Preferably the at least one portion is formed by a forming process such as match metal forming or high pressure forming.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the present invention will now be described  
5 by way of example only, with reference to the accompanying  
diagrams which are:

Figure 1 an isometric view of a sheet form member in  
accordance with a first embodiment of the present invention;

Figure 2 a plan view of the sheet form member of Figure 1;

10 Figure 3 a side view of the sheet form member of Figure 1;

Figure 4 an enlarged side view of a portion of the sheet  
form member of Figure 1;

Figure 5 a cross-sectional side view along line A-A of the  
sheet form member of Figure 2;

15 Figure 6 an isometric view of a component part in accordance  
with a second embodiment of the present invention;

Figure 7 schematic illustrations of steps involved in a  
first process of producing a formed sheet of Figure 1 in  
accordance with a third embodiment of the present invention;

20 Figure 8 schematic illustrations showing steps involved in  
a second process of producing a formed sheet in accordance with  
a fourth embodiment of the present invention;

Figures 9(a) and 9(b) isometric and side views of a sheet  
form member prior to forming in accordance with a fifth  
25 embodiment of the present invention;

Figure 10 a schematic illustration of a process of applying  
an ink coating to a reverse side of a formed sheet in accordance  
with a sixth embodiment of the present invention; and

Figure 11 schematic illustrations of the process steps of creating a formed sheet having printing on a obverse and reverse side of a raised portion in accordance with a seventh embodiment of the present invention.

#### DETAILED DESCRIPTION OF DRAWINGS

Referring initially to Figure 1, there is provided a sheet form member, or "applique", generally represented by reference numeral 10, according to a first embodiment of the present invention.

The sheet form member 10 has two upstanding portions 12 integrally formed thereon, each upstanding portion 12 having a height 14 which is greater than 4 mm, and, in this embodiment, around 7.5 mm above a front surface 16 of the sheet form member 10.

In this embodiment, the upstanding portions 12 are continuous, forming a circular closed shape ring on the front surface 16 of the sheet form member 10, for use as a decorative panel, for example, for an instrumentable panel of an automotive vehicle. The raised portions 12 may alternatively be of any other shape generally used for the surround that outlines display gauges of automotive vehicles.

Referring now to Figures 2 and 3, the sheet form member 10 has printing on the front surface 16 and/or a reverse surface 18. The printing in this instance corresponding to data relating to engine speed (rev) counter and speed of vehicle.

The sheet form member 10 is made of a polycarbonate plastics material which is about 0.375 mm thick, which means the sheet

form member 10 is pliable such that it may take the shape of a surface which is not completely flat and to which the sheet form member 10 is affixed in use.

5 The reverse surface 18 of the sheet form member 10 is coated with a pressure sensitive adhesive in order that the sheet form member 10 can be attached to a backing part 19 so as to form a component 40 that is used to create the facia of the instrumentable panel of an automotive vehicle, as shown in Figure 6.

10 Rings 20, 22 formed by the upstanding portions 12 are spaced apart such that outside walls of each of the two rings 20, 22 are about 45 mm apart.

15 In addition, the surfaces 16, 18 of the sheet form member 10 form a substantially flat planar surface, a portion of which planar surface is surrounded by the rings 20, 22 which have a diameter of about 51 mm.

Referring now to Figure 4, there is shown detail of the raised or upright portion 12. It can be seen that the upright portion 12 comprises a first wall 24, a second wall 26, a top part 28 and has an open base 30. In this embodiment the base 20 30 has a width from the inside of the first wall 24 to the outside of the second wall 26 of 6.8 mm.

In addition, the first wall 25 is convex in shape when viewed from a front of the sheet form member 10, the first wall 25 24 having a radius of about 13 mm.

The second wall 26 of the upright portion 12 is substantially vertical having only a shallow incline to the top part 28, creating an angle of about 92° between the first surface

16 of the sheet form member 12 and the second wall 26. The top part 28 is also angled, the first wall 24 being slightly higher than the second wall 26. In addition, the top portion 28 has a radius of typically 0.5 mm.

5 Referring now to Figure 6, there is shown a component part 40 according to a second embodiment for an automotive vehicle. The component part 40 comprises a sheet form member 10 according to the first embodiment of the present invention, wherein the sheet form member 10 is mounted to a rigid backing piece 19.

10 Referring next to Figure 7, there is illustrated a method of forming a sheet form member 10 as shown in Figure 1 according to an embodiment of the present invention. The steps involved in producing the sheet form member 10 are to provide a substantially planar sheet 10 which can be a polycarbonate substrate 46. A design is then applied to the substrate 46 by  
15 first surface and/or second surface printing. The next step can then involve applying a hard or protective coat layer 48 to protect the ink design laid down on the substrate 46.

When the substrate 46 is ready to be shaped, that is to say  
20 have upstanding portions 47 created in the substrate 46. The substrate 46 is exposed to a match metal forming process which involves heating the substrate 46 and shaping or forming the substrate 46 by use of two dies 49, 50 between which the substrate 46 is sandwiched. Alternatively a high pressure forming process  
25 may be used. The resultant shaped substrate or formed applique 52 may then be moulded or affixed to a backing piece or component part 54 to which the design and shape of the formed applique is required, by use of a moulding tool 56.



In one embodiment the raised portions 12 are coated with an ink having a chrome aluminium pigment giving the raised portions 12 a mirror type finish.

5 The height of the upstanding portions 12 can typically be between 4 mm and 9 mm. The base 30 can be between 5 to 9 mm and the radius of the first wall 24 can be between 10-20 mm.

10 In an alternative embodiment, the substrate 46 from which the sheet form member 10, is created can be a laminate and formed from a process as shown in Figure 8. After printing has been applied to the relevant surfaces of a first substrate layer 58 an adhesion promoter 60 is applied to a reverse surface 62 of the substrate 58 a second substrate layer 64 is applied to the reverse surface of the first substrate layer 58 to create a laminate 66. The laminate 66 is then passed through heated  
15 pressure rollers and the resultant laminated sheet 66 is exposed to the match metal forming or high pressure forming process so as to create the required shape.

20 Providing a sheet form member 10, having upstanding portions 12 integrally formed thereon eliminates the need to create individually formed rims and then affix the rims to the sheet form member 10, thereby reducing the number of manufacturing assembly steps and the associated costs involved therewith. In addition, the process of match metal forming has the added advantage of alleviating or reducing the problem of wrinkles  
25 being formed on the planar sheet in the vicinity around the first and/or second walls 24, 26 of the upstanding portion 12.

Referring to Figures 9(a) and (b), in a fifth embodiment of the present invention there is provided sheet form member 70 of

Figure 1 prior to forming of the portion 12. The member 70 has an ink coating 72 applied to a front obverse surface 74 thereof. The ink coating 72 is a high temperature resin based ink which is plastics based and typically copolycarbonate based, the copolycarbonate comprising a combination of bisphenol A and a new bisphenol, bisphenol TMC.

The ratio of the bisphenol components determines the properties of heat resistance, or glass transition temperature which increase with the bisphenol TMC content. In addition, as the bisphenol TMC content of the copolycarbonate increases so does its solubility in non-halogenated solvents, due to the more pronounced aliphatic nature of the copolycarbonate.

The ink coating 72 is, therefore, made from a copolycarbonate material dissolved in a non-halogenated solvent having a chrome aluminium pigment added thereto.

The ink coating 72 is applied to the sheet form member 70 such that it creates an annular design closed shape having a width of typically 8 mm.

The sheet form member 70 can also have a design applied by first and/or second surface printing.

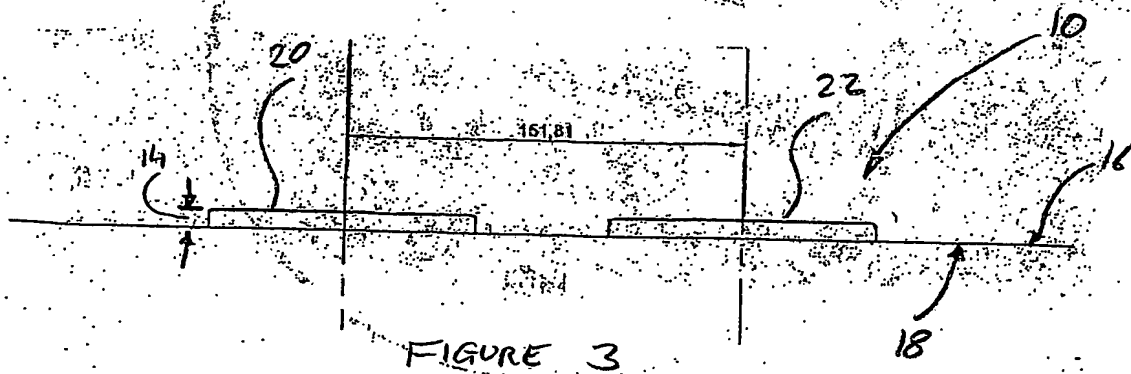
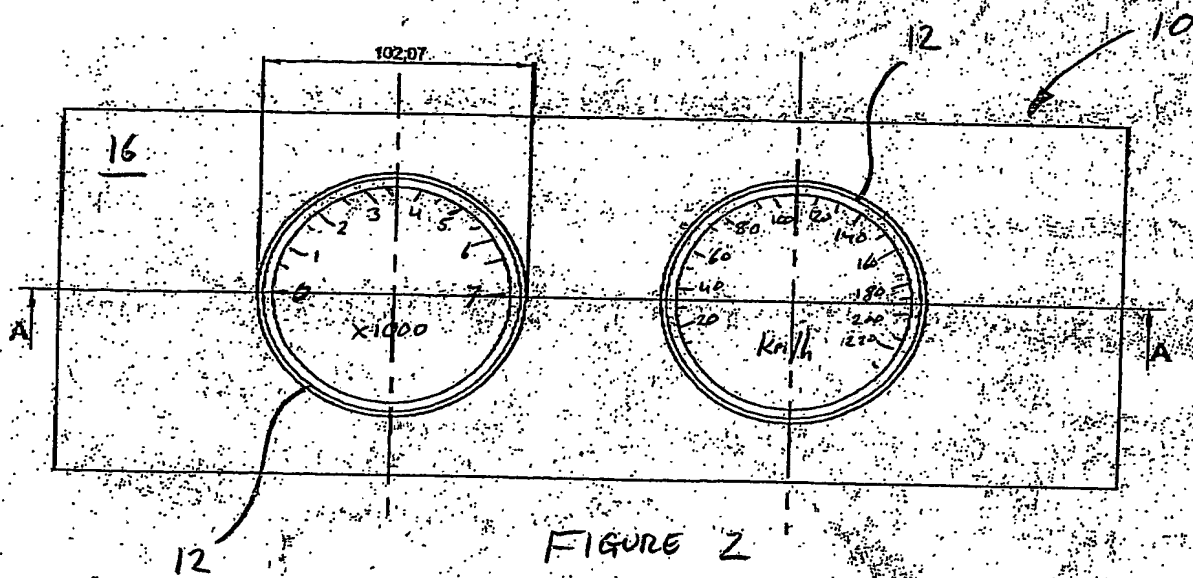
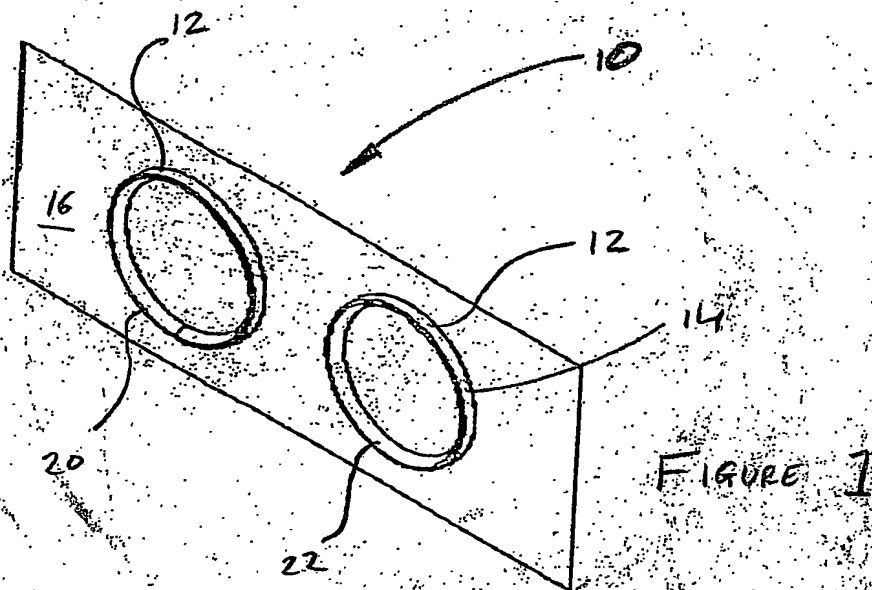
In one embodiment the sheet form member 70, which has the ink coating 72 applied to it, may be subjected, e.g., to a match metal forming process, as described herein above, in order to create upstanding portions that are coincident with the ink coating 72. That is to say, the sheet form member 70 has chrome like rims integrally formed therewith.

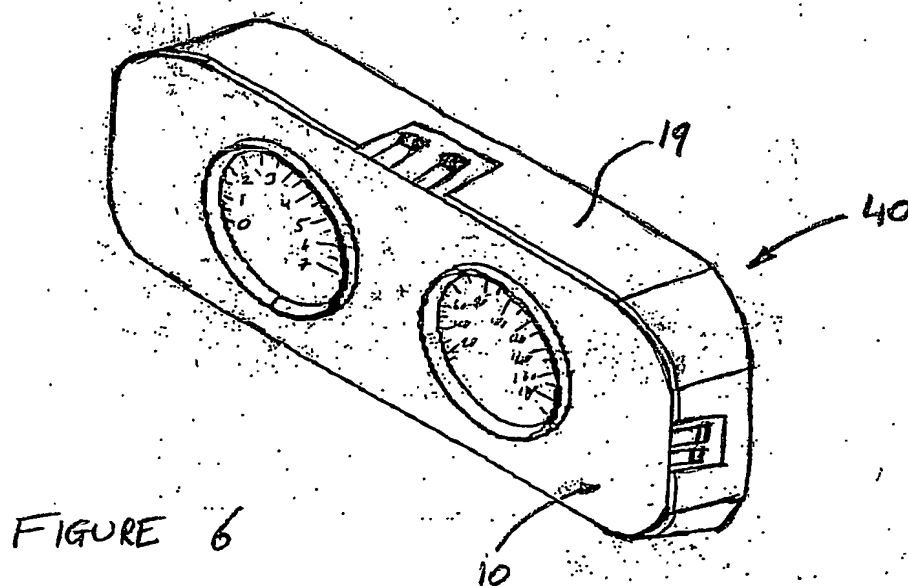
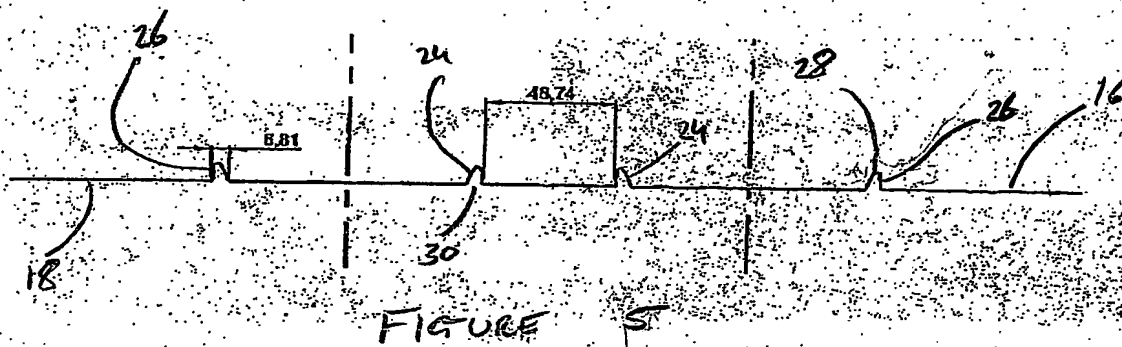
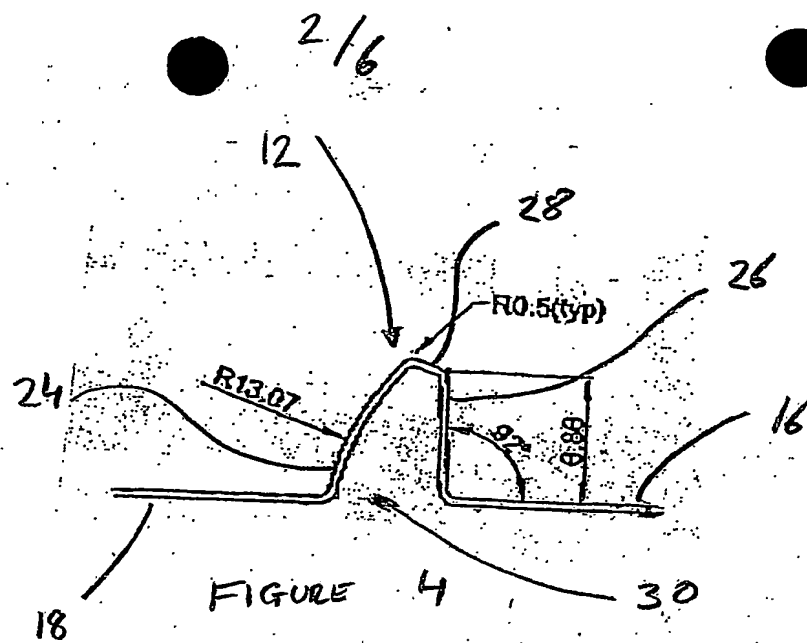
The application of an ink coating 72 of a high temperature resin based ink to a planar sheet form member provides the added

advantage of producing a sheet form member that can be manipulated by a forming process, such as match metal forming, to produce raised portions coincident with the ink coating, due to the elastic and high temperature resistance of such resin based inks.

To increase the opacity of the mirror like rims, after the sheet form member has been subjected to the match metal forming or high pressure forming process, it may be required to apply an additional coat of ink to a reverse side 76 of the formed sheet form member 70. This additional coat of ink can be applied either by a tampo or a pad printing process as shown in Figure 10 or alternatively by masking or spraying. The printing process involves the use of a suitable shaped applicator 78, which in this embodiment would be annular and made of a material such as silicon rubber, in order to apply the additional coat of paint. The additional coat of ink can be the same ink used on the obverse surface 74 of the sheet form member 70. Alternatively, the additional coat of ink may be a black or white ink used to increase the opacity of the chrome like rims when viewed from the obverse side.

Various modifications may be made to the foregoing without departing from the scope of the invention, for example the sheet form member 70 may be laminated as described herein above. In addition, the step of applying the additional coat of ink can be applied on the reverse side of the laminated sheet before the match forming process is performed as shown in Figure 11. The additional coat of ink being an opaque ink that mirrors the printing of the ink coating 72 on the obverse surface 74.





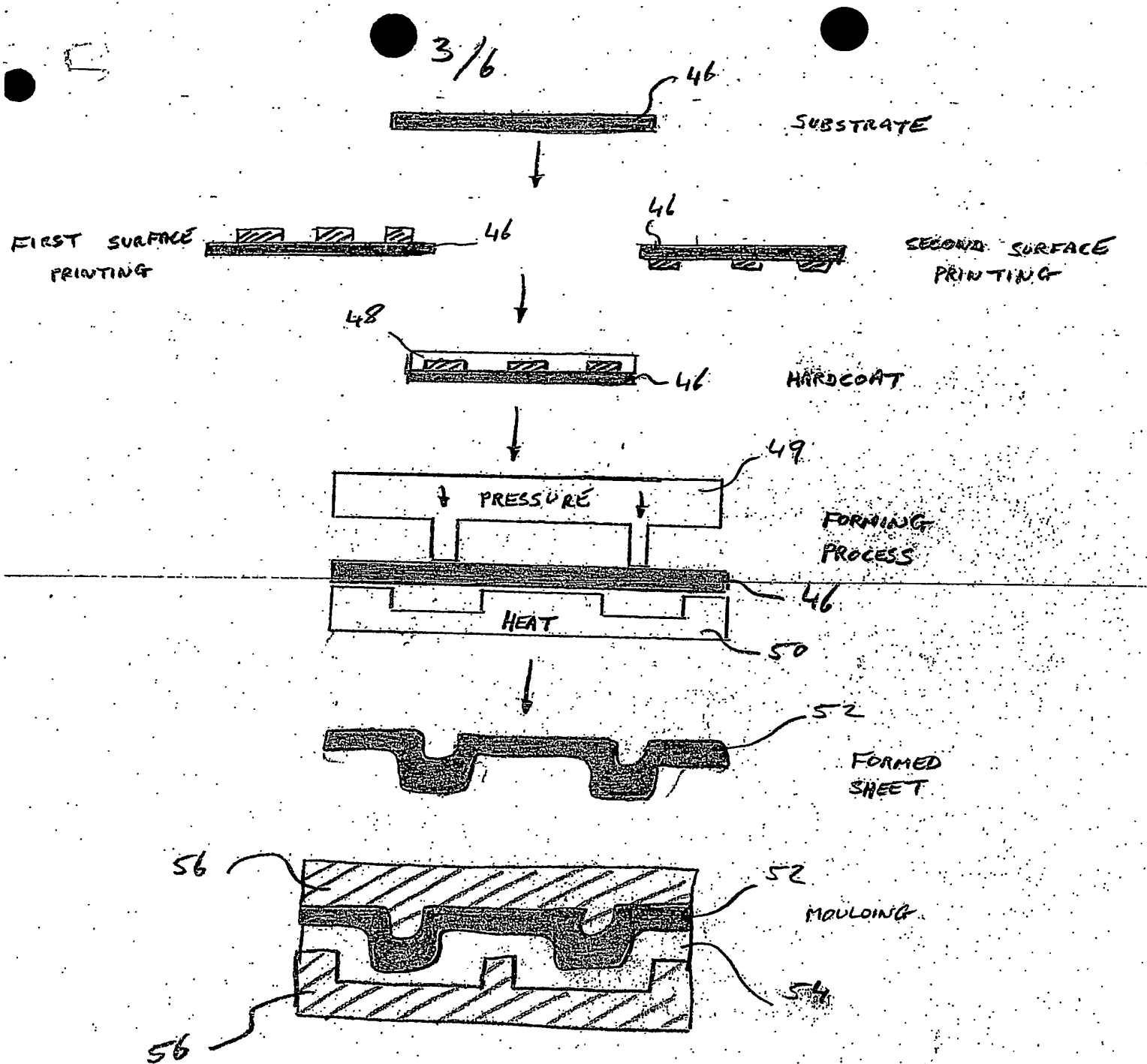


FIG 7

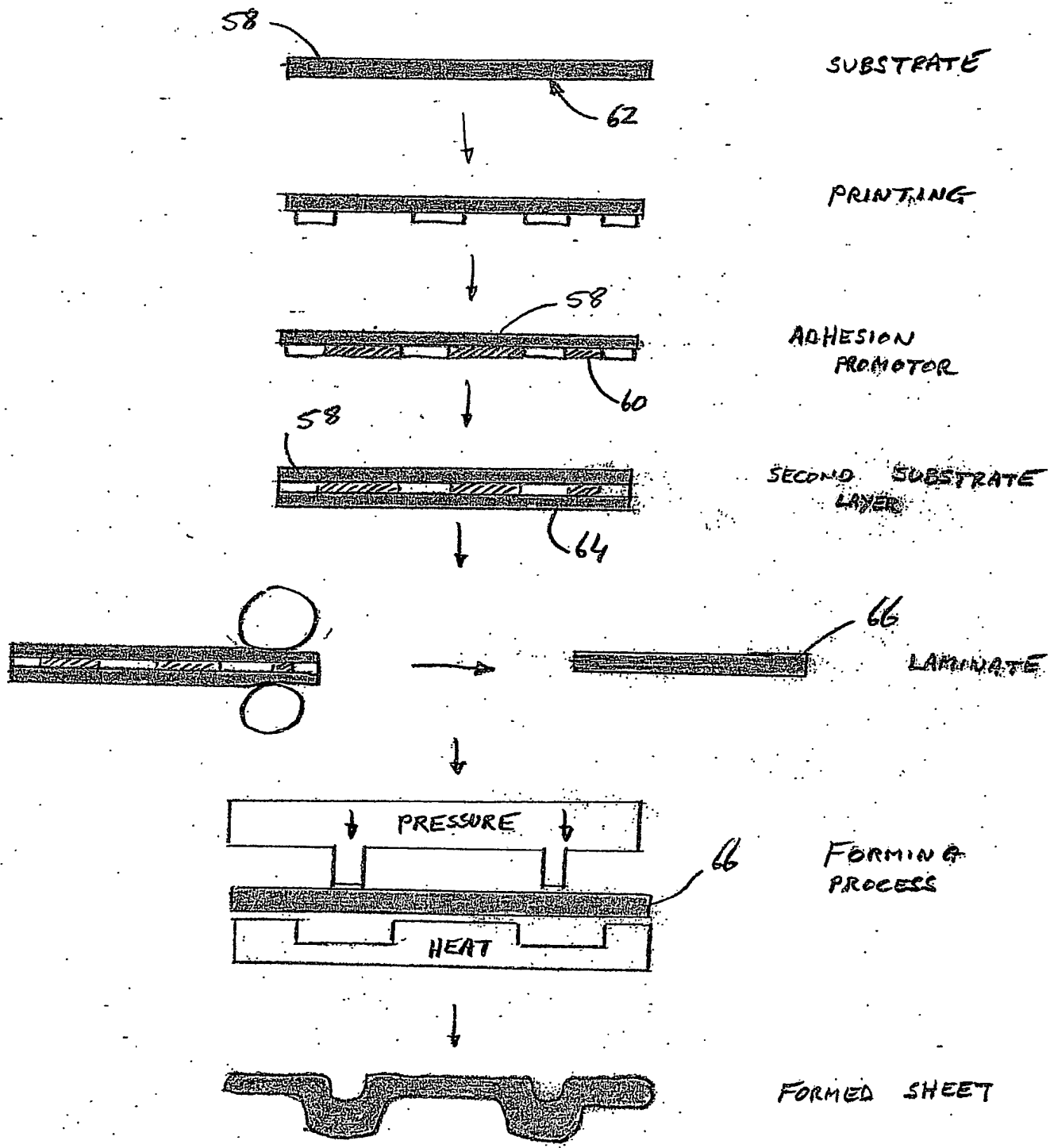


FIGURE 8

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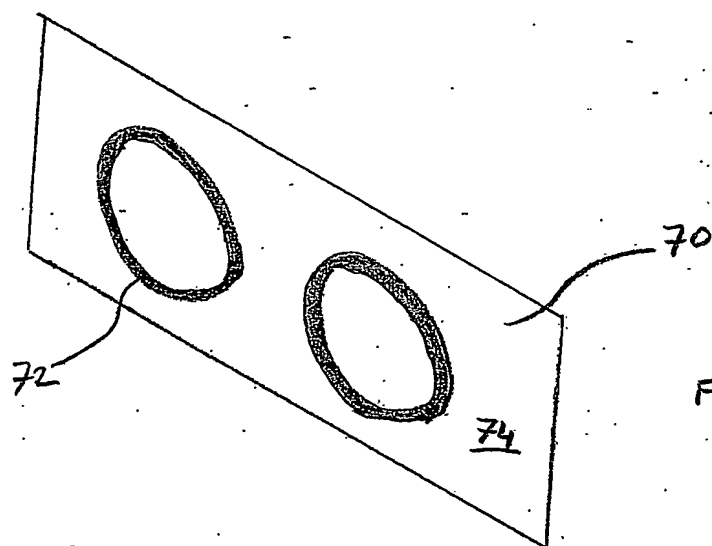


FIGURE 9(a)

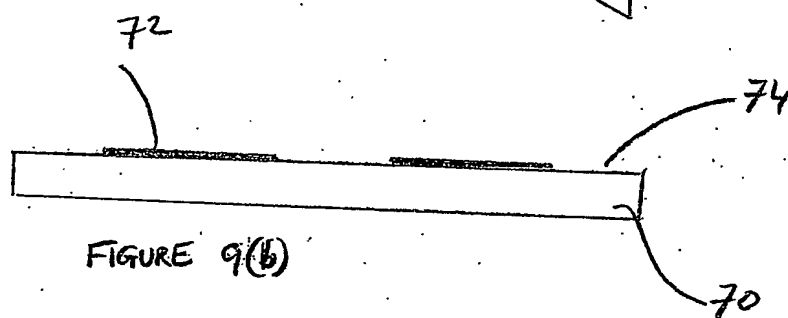


FIGURE 9(b)

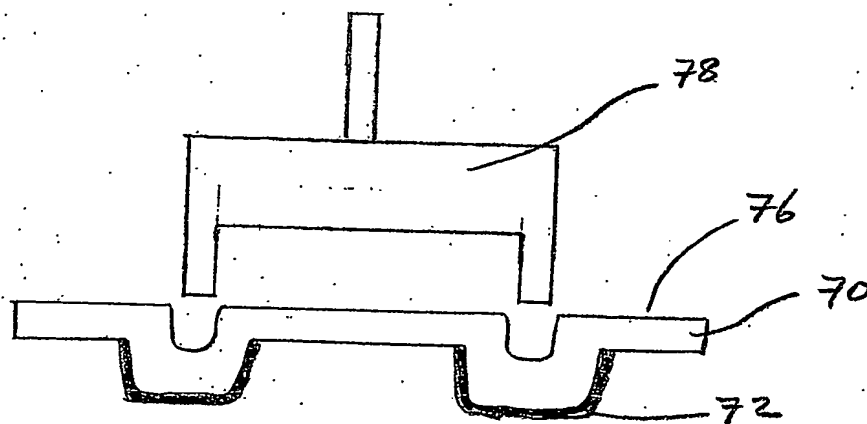
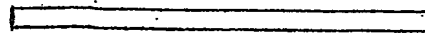


FIGURE 10



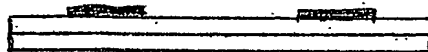
6/6



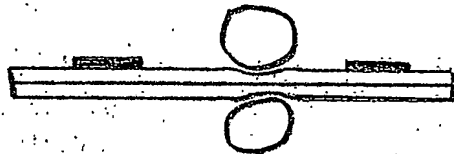
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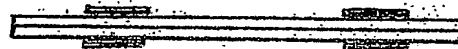
PRINTING



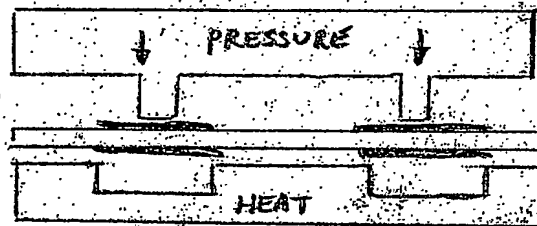
SECOND SUBSTRATE  
LAYER



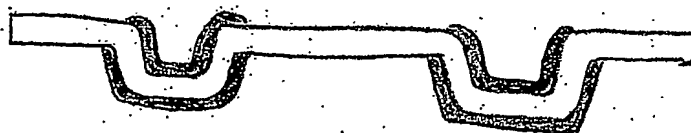
LAMINATE



PRINTING



FORMING  
PROCESS



FORMED  
SHEET

FIGURE 11

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